CLAIMS

What is claimed is:

1. An apparatus, comprising:

an elongated source of a therapeutic agent to deliver a dose of the therapeutic agent to a vessel, the source having gradients of therapeutic agent concentrations near a proximal end and a distal end of the elongated source.

2. The apparatus of claim 1 wherein the gradients comprise therapeutic agent concentrations gradually decreasing near the proximal end and the distal end of the elongated source.

3. The apparatus of claim 1 wherein the source comprises a radioactive intravascular stent.

4. The apparatus of claim 1 wherein the source comprises a radiation source wire.

5. The apparatus of claim 1 wherein the source comprises a drug delivery stent having an anti-cell proliferation drug for treatment of the vessel.

6. An apparatus, comprising:

an elongated radiation dose delivery source having a radioactive region thereon, the radioactive region having a proximal end and a distal end, a therapeutic radioactivity level between the proximal end and the distal end, the radioactive region also having regions of radioactivity gradients to transition from the therapeutic radioactivity level to a non-therapeutic radioactivity level near the proximal end and the distal end.

7. The apparatus of claim 6 wherein the radiation dose delivery source comprises an intravascular stent.

8. The apparatus of claim 6 wherein the radiation dose delivery source comprises a radiation source wire.

9. The apparatus of claim 6 wherein the therapeutic radioactivity level gradually decreases to the non-therapeutic radioactivity level within the regions of radioactivity gradients.

10. The apparatus of claim 6 wherein the radioactive region comprises a beta particle emitting isotope.

11. The apparatus of claim 6 wherein the radioactive region comprises a gamma particle emitting isotope.

12. The apparatus of claim 6 wherein the radioactive region comprises a beta particle and a gamma particle emitting isotope.

13. A method, comprising:

providing an elongated radiation dose delivery source;

forming a radioactive region on the delivery source, the radioactive region having a proximal end and a distal end, a therapeutic radioactivity level between the proximal end and the distal end; and

forming regions of radioactivity gradients on the radioactive region near the proximal end and the distal end, the radioactivity gradients transitioning from the therapeutic radioactivity level to a non-therapeutic radioactivity level.

14. The method of claim 13 wherein forming the regions of radioactivity gradients comprises uniformly decreasing the radioactivity level from the therapeutic level to the non-therapeutic level.

15. The method of claim 13 wherein forming the regions of radioactivity gradients comprises variably decreasing the radioactivity level from the therapeutic level to the non-therapeutic level.

16. The method of claim 13 wherein forming the regions of radioactivity gradients comprises decreasing the radioactivity level by incremental steps from the therapeutic level to the non-therapeutic level.

17. The method of claim 13 wherein forming the radioactive region comprises coating the delivery source with isotopes by ion beam implantation.

18. The method of claim 17 wherein forming the regions of radioactivity gradients on the radioactive region comprises gradually decreasing an ion beaming time.

19. The method of claim 13 wherein forming the radioactive region comprises coating the delivery source with isotopes by plasma implantation.

20. The method of claim 19 wherein forming the regions of radioactivity gradients on the radioactive region comprises masking the proximal end and the distal end of the radioactive region with radioactivity shields.

21. An intravascular stent, comprising:

a radioactive region along an elongated length of the stent to deliver a radiation dose to a vessel wall, the radioactive region having an area of substantially uniform radioactivity level to provide a therapeutic dose to the vessel wall, the uniform radioactivity level localized near a central portion of the stent, the radioactive region also having radioactivity level gradients near a proximal end and a distal end of the stent, the radioactivity level gradients to decrease gradually the dose delivered to the vessel wall from the therapeutic dose level to a non-therapeutic dose level, the gradients to decrease from a point inward of the proximal end to or near the proximal end, and to decrease from a point inward of the distal end to or near the distal end of the radioactive region.

22. The stent of claim 21 wherein the radiation dose delivered to the vessel wall inhibits vessel cell proliferation along the elongated length of the stent and past the proximal end and the distal end of the stent.

23. The stent of claim 21 wherein the area of substantially uniform radioactivity level comprises a greater longitudinal length than each of the gradients.

24. The stent of claim 21 wherein the gradients comprise a uniform rate of decrease of radioactively level.

25. The stent of claim 21 wherein the gradients comprise a variable rate of decrease of radioactivity level.

26. The stent of claim 21 wherein the gradients comprise a decrease of radioactivity level by incremental steps.

27. The stent of claim 21 wherein the radioactive region comprises a beta particle emitting isotope.

28. The stent of claim 21 wherein the radioactive region comprises a gamma particle emitting isotope.

29. The stent of claim 21 wherein the radioactive region comprises a beta and a gamma emitting particle isotope.

30. The stent of claim 21 wherein the radiation dose comprises up to 60 Gray.

31. An intravascular stent, comprising:

a drug delivery region along a surface of an elongated length of the stent, the drug delivery region having a variable drug concentration thereon to deliver a drug dose to a vessel wall, the drug delivery region having an area of substantially uniform drug concentration to provide a therapeutic dose to the vessel wall, the substantially uniform drug concentration localized near a central portion of the stent, the drug delivery region also having drug concentration gradients near a proximal end and a distal end of the stent, the drug concentration gradients to decrease gradually the dose delivered to the vessel wall from the therapeutic dose level to a non-therapeutic dose level, the gradients to decrease from a point inward of the proximal end to or near the proximal end, and to decrease from a point inward of the distal end to or near the distal end of the drug delivery region.

32. The stent of claim 31 wherein the drug dose delivered to the vessel wall inhibits vessel cell proliferation along the elongated length of the stent and past the proximal end and the distal end of the stent.

33. The stent of claim 31 wherein the drug delivery region comprises a plurality of indentations on the surface of the stent to accommodate a drug for the variable drug concentration.

34. The stent of claim 33 wherein the substantially uniform drug concentration comprises a uniform distribution of the plurality of indentations on the surface of the stent near the central portion.

35. The stent of claim 33 wherein the concentration gradients comprise the plurality of indentations on the surface of the stent to decrease gradually in distribution from the central portion to the proximal end and to the distal end of the stent.

36. The stent of claim 33 wherein the proximal end and the distal end of the stent comprise the plurality of indentations having decreased distribution compared to the plurality of indentation near the central portion of the stent.

37. A method, comprising:

providing an elongated, intravascular drug source;

forming a drug region on the drug source, the drug region having a proximal end and a distal end, a therapeutic drug concentration level between the proximal end and the distal end; and

forming regions of drug concentration gradients on the drug region near the proximal end and the distal end, the concentration gradients transitioning from the therapeutic drug concentration level to a non-therapeutic drug concentration level.

38. The method of claim 37 wherein forming the regions of drug concentration gradients comprises uniformly decreasing the drug concentration level from the therapeutic level to the non-therapeutic level.

39. The method of claim 37 wherein forming the regions of drug concentration gradients comprises variably decreasing the drug concentration level from the therapeutic level to the non-therapeutic level.

40. The method of claim 37 wherein forming the drug region comprises indenting a surface on the drug source to accommodate a drug.

41. The method of claim 37 wherein forming the drug region comprises dipping the drug source in a drug.

42. The method of claim 41 wherein forming the regions of drug concentration gradients on the drug region comprises masking the proximal end and the distal end.

43. The method of claim 37 wherein forming the drug region comprises coating the drug source with a drug.

44. The method of claim 43 wherein forming the regions of drug concentrations gradients on the drug region comprises varying a translational drug spraying speed.

45. The method of claim 40 wherein forming the regions of drug concentration gradients on the drug region comprises gradually decreasing a distribution of indentations towards the proximal end and the distal end of the drug region.